Rebuilding Haiti after the Earthquake

By, Javed Sultan (RA)
Executive Director, SARID Inc. (www.sarid.net)

Government Buildings Damaged

A visit to Haiti this summer brought home the daunting challenge that the nation faces after the devastating earthquake of 2010. The scars of the damage are everywhere - from damaged homes crumbling by the thousands, to collapsed multi-story concrete structures, to ruined infrastructure and economy. The damage is immeasurable as seen in a Government building at left. Tent cities proliferate, as the engineering world knows how to provide temporary shelter after an earthquake, but not when it comes to providing affordable and permanent homes especially if it is a poor country.

This has been the case in the last decade with poor reconstruction effort after an earthquake, as reported in media and through eye witness reports, from Indonesia, Peru, Pakistan and now Haiti. Very few strategies have tied construction to job creation and/or economic stimulus. These failures will continue unless the limitations of the current building technologies, and the market forces that drive it, are better understood. What Haiti needs is not more aid but instead a reconstruction strategy that allows it to tap into its underutilized resources and nascent economy. A strategy that will rely on affordable building practices, provide jobs to its unemployed men and women, and one that looks inwards to its local economy rather than outward to the world economy. Otherwise Haiti will never be able to stand on its own feet and the tent cities and ramshackle buildings will morph into permanent slums and ghettos.

Living in tents and shared facilities

Dependence on foreign aid and technology seen as panacea may prove to be a poison that will further impoverish the country, increase its dependence on international aid agencies, mortgage the country's future, and stifle her industries. Two years after the earthquake, in which over 300,000 people died and nearly one million were displaced, much remains to be done. A large number of people, mostly the poorest and the middle class, continue to live in tents and improvised dwellings - compelled to share toilets and cooking facilities. Although our visit was limited to Port Au Prince and the Leagone area we are told that the situation is equally dire in large parts of Haiti. Lack of jobs and limited resources compound the misery further. The situation is heart wrenching and Haitians continue to face the odds bravely.

Improvised and salvaged shelters

With the global economy in recession, and international aid agencies straining to keep up with numerous appeals worldwide, Haitians must pick up the pieces themselves. Mechanized construction with its dependence on imported fossil fuels, imported wood and steel technology, will only increase the country's dependence on imported goods. Hard work, participation in the construction process through sweat equity, instead will promote a self-

Wood frame with Plywood Sheathing

sustaining technology tethered to indigenous resources and industry.

This delay in recovery, although painful and long overdue, may allow it to recover on a more sound footing. Given the ingenuity and resolve one finds in Haiti, its people must select wisely the building technologies that will rebuild their country – and not be seduced by hype and false promises.

The Haitian government is trying to do its best to ensure that future construction is safe. We are given to understand that building codes are being drafted to conform to international building standards for earthquake resistant structures. The systems that are being encouraged, and correctly so, are what are termed in engineering as elastic structures such as steel and wood frame buildings . These types of structures dissipate the forces and energies that adversely impact buildings during an earthquake – without damaging the structure.

Another alternative is reinforced masonry structures, although it is not as elastic as wood or steel, but it is equally effective against earthquake. Drawback with all these technologies is they are resource driven, rely on imported steel or wood - and very often require skilled labour, and are not affordable.

Also developed economies are able to afford such structures because of bank loans, tax incentives, mortgages and other financial vehicles – which spread the cost of owning a home over decades. With no such financial vehicles in developing economies, such as Haiti, the above mentioned building technologies are far from affordable. Unfortunately the professionals, architects and engineers, advising the Government may not understand the macro-economic objectives of Haiti and may be singularly focused on technologies that are practiced and adapted to more developed economies.

Plastic waste that can be recycled

The building types that we saw being promoted, especially for affordable housing, by contractors, engineering consultants, and vendors are imported wood or steel frame structures with some form of sheathing and more often than not plywood sheathing - as seen in the picture on the left- above. These buildings may be appropriate where commercial construction is concerned, or developed economies are concerned, but it is less desirable for housing in Haiti. For example in developing economies, out of necessity, people cook with open fire - hence wood structures are a major cause and victim of accidental fire .There are no fire trucks to rush to multiple sites to put out a fire in case of an accident. These homes will become tinder boxes. Even in USA, despite the availability of fire fighting equipment, due to the reliance of housing industry on wood frame structures, damage to homes by fire remains the single biggest hazard.

Even though the above wood and steel framed and wood sheathed structures are being presented by vendors and contractors from advanced countries as the only permanent solution - they are neither permanent, safe or the only option. Especially wood-sheathed structure's life span is severely restricted by Haiti's climate, termites, annual hurricanes and other factors. Buildings after just one or two years of construction show signs of decay, and damage by insects and rodents. Residents complain about

flooding after heavy rains and where un-insulated corrugated roofing sheets are used, which is the norm because of affordability issues, the structures get unbearably hot in the Haitian summer. The proposed structures are not only not taking advantage of indigenous resources but also not recycling the waste. We saw a lot of Styrofoam coffee cups and plastic water bottles that can easily be salvaged and recycled and utilized in construction technologies similar to ours. As we speak these trash are littering the streets, drains and open fields, or are being buried underground for millions of years. An ecological disaster in the making.

Buildings using author's fero-cement affordable technology

So are there other options for Haiti and the answer is a resounding yes.

With what it costs to build these plywood sheathed structures, Haitians can build more affordable permanent structures out of reinforced concrete – utilizing resources available in Haiti. Such building proto-types are difficult but not impossible, and at the risk of sounding self-serving, have been successfully executed by the author in other seismic (earthquake) zones, as seen in one example in a building above on the right. Our proposed technology, similar to what was utilized in the building above, is a reinforced concrete (RCC) strategy that utilizes cast-in-place construction - which utilizes 30% to 50% less cement and reinforcement, depending on the required seismic resistance and quality of finishes, than comparable RCC or masonry structures – and would be a more promising alternative. It is an engineered building, designed by licensed structural engineers, that conforms to International Building Codes for seismic construction.

Finished interiors - author's technology

It is a technology that utilizes less skilled labour – thereby giving jobs to the unemployed, relies on internal resources, and is comparatively cheaper. This building method will allow for incorporation of recyclable waste. Haitian's could be taught to use this technology and build their homes by themselves – as the author has taught people in other countries. The proprietary technology, patent pending, will be available free of charge and on an open source basis. It was developed for poor countries in mind.

Author's technology with higher finishes

For example the three bedroom house above right was built in 2006 by the author in Kashmir, Pakistan. It is earthquake resistant and high wind resistant. Walls and roof have an average insulation value higher than what is normally available in homes in USA. Six years after their construction buildings show no sign of structural distress even though these structures have endured high winds and earthquakes of intensity Richter 5.5+.

Our estimate is that buildings built with this technology will be far more affordable than competing technologies such as masonry, or wood and steel frame structures with plywood sheathing. It will create

employment for people and give them a safe, non-combustible and non-wood structure. Price advantage have been validated by the author with numerous building in other countries.

Similar strategies, and more affordable options for Haiti, would make it possible for Haitians to build permanent homes by themselves. New techniques, with our technology, will allow the roof to be flat so that the homeowner in time can grow his building vertically (multi-story). The techniques learnt can then be utilized for helping third party contractors build residences and commercial buildings with higher finishes as shown on the two pictures of residence above on left – built again with the author's technology. The proposed technology may not be the only one of its kind but it does respond to Haiti's needs as it will be affordable, create jobs and will be less dependent on foreign aid and imported building material.

Hence what is required in Haiti is not more money but a more country specific building technology that takes her limitations into consideration, leverages local resources, employs its vast pool of unskilled labour, recycles its waste, and focuses on capacity building with more modest but safe building structures. With a much smaller carbon footprint the structures built will be more eco-friendly. The proposed strategy will act as a catalyst for growth of small scale industries and will revitalize many sectors of the Haitian economy.

Javed Sultan (MS Arch & CE)
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